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Getting Acquainted in Second Life

Human Agent Interactions in Virtual Environments

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ABSTRACT

The paper investigates human agent interactions in virtual environments like Second Life. As interactions in such environments are inherently social, the agent should be able to participate in social interaction rituals like getting acquainted when meeting someone for the first time. The differences between these rituals in real life and in Second Life are analyzed. Different rule sets for each version of the ritual have been developed and the performance of the different sets is compared in interactions with users in Second Life.

Categories and Subject Descriptors

H.1.2 [Models and Principles]: User/Machine Systems—*human factors, human information processing*; I.2.1 [Artificial Intelligence]: Applications and Expert Systems

General Terms

Human factors

Keywords

Second Life, Social modeling, Virtual agents

1. INTRODUCTION

Immersive virtual worlds like World of Warcraft or Second Life have become popular tools for collaborative games and social interactions. An important factor for enhancing the experience in such settings is trust of the users, which is essential in enabling such collaborative and social interactions. Different types of trust can be distinguished like the trust in the system and its operations, the trust that (private) data is handled in a secure fashion, or the trust towards each other and towards non-player characters. Especially the last point is crucial in establishing a relation between users and/or virtual characters. Users interact with other users (or autonomous agents) in simulated face-to-face encounters. Thus, some of the aspects of such face-to-face encounters might transfer to the virtual. But the user cannot

be sure to interact with another user in the form of an avatar but might be dealing instead with an autonomous system in the form of a virtual agent. This raises the question if it is possible to establish trust with the user when the interaction partner is a piece of software like an autonomous character posing as one of the inhabitants of the virtual world. In this paper, we tackle this challenging question by focusing on one of the most important building blocks of trust, the first meeting.

The virtual world we have chosen for this endeavor is Second Life. It can be seen as a multiagent system where users in the form of avatars and autonomous virtual agents can engage in social interactions. This offers rich opportunities for employing intelligent virtual agents in large scale real life scenarios for instance as intelligent tutors, as persuasive devices or as game partners. Additionally, from a research perspective, large scale evaluations with real users become feasible in the users' natural environment.

What is needed in all scenarios is the trust of the user in order to convince him to interact for an extended time with the virtual agent. One of the fundamental blocks in trust building is the first step into the conversation, i.e. getting acquainted with the interlocutor. In the next section, work is presented that is concerned with building trust in virtual worlds and especially in first meetings between strangers. The remainder of the paper then examines different strategies in real life and in Second Life and how we have modelled these strategies for virtual agents in Second Life. An evaluation is presented that compares the performance of the different communication strategies.

2. RELATED WORK

The main focus of the paper is on how to establish trust in a virtual environment. Ultimately, this means having to measure the trust of the user in his interaction partner, which is a virtual agent in our case. What is evident from the literature is a lack of valid measures of trust either in pervasive or in virtual environments. But there are some promising starting points when dealing with collaborations in virtual environments.

Virtual worlds are computer mediated communication and collaboration tools. To further collaborative work, it is necessary to establish trust between interaction partners that have never met face to face. Additionally, Second Life and

similar environments are ideal playgrounds for virtual agents for instance in the form of intelligent tutors, persuasive agents, or personal assistants. In all cases, the user has to trust the agent in order to allow for successful task completions. Thus, the question how trust can be established in such a collaborative environment is not only relevant for CSCW but also for interactions with virtual agents in social environments.

Zheng and colleagues [17] show that social initial getting acquainted activities increase trust even without having met prior to the interaction. To this end they compare how trust is established based on five different initial conditions. Face to face meetings before the collaboration have been the most successful, followed by social text-based chat, i.e. chat interactions in which users got acquainted before tackling the task. Less successful were the display of a persistent image of the interaction partner during the interaction or static textual information about the interaction partner. The worst result was obtained when the task was immediately started. The social text-based chat is the next best means compared to the face to face meeting and was even similar on some measures. It can be expected that an environment like Second Life will be in between as the main form of communication is text-based chat with the additional effect of a simulated face to face meeting. Consequently, to ensure successful interactions of an agent with a user in such an environment, the agent should be able to engage in initial social getting acquainted activities. Brown and Bell [3] additionally show that social interactions improve the social presence felt in the virtual environments which again is an argument for the agent's ability to engage in these interactions.

Cassell and Bickmore [4] highlight the fact that interaction rituals are essential devices to build trust in face to face interactions and exploit small talk as one such ritual. Getting acquainted when two people meet for the first time has successively been described as one of the main factors of initial trust building. According to Kendon [9], this conversation scenario is not only found in all cultures but it also plays an important role for managing personal relations by signaling for instance social status, degree of familiarity, or degree of liking. For Argyle [1], a first meeting is a ritual that follows pre-defined scripts. Ting-Toomey [16] follows his analysis by denoting a first meeting as a ceremony with a specific chain of actions. Knapp and Vangelisti [10] emphasize a first meeting as a step into the life of someone else, which is critical for a number of reasons like face-keeping or developing a network of social relation. Thus, the ritualistic nature of a first meeting makes sense in order to "to be on the safe side" by establishing such a new relationship in a satisfactorily, i.e. facekeeping, manner for both sides. Consequently, it is safe to say that the challenge of building trust between a virtual agent and the user in a virtual environment starts with the initial meeting, with getting acquainted. Next, we examine how these rituals are executed in face to face meetings and if there are differences if such a meeting takes place in a virtual environment like Second Life.

3. GETTING ACQUAINTED IN REAL LIFE

First meetings have been shown in general to follow some rules on how to structure such an encounter. [1] as well as [16] for instance, describe such interactions as rituals or cer-

emonies, which follow pre-defined scripts. An in-depth analysis of these scripts was presented by Svennevig [15], who concentrates on the conversational structure of first meeting interactions. He identifies two partly recurring units that are explained next.

3.1 Self Presentation

The main goal of the first minutes of a conversation between strangers is to establish a bond and trust between the so far unknown interlocutors. A bond is a normative relation that derives from a number of mutual rights and obligations. Trust is a cognitive category that is based on mutual knowledge and personal information about each other. Affect can be seen as an emotional third component of relations but does not play an extensive part while getting acquainted for the first time. Svennevig presents three elementary actions of self-presentational sequences (see example below):

1. Question to elicit self presentation of other: Such a question is personal but not intimate and can either refer to the interlocutor's group affiliation (bond) or to biographical information (trust).
2. Self presentation of other: Either minimally signaling rejection of the topic or elaborate answer giving additional details.
3. Reaction to self presentation
 - (a) Minimal acknowledgement signaling indifference
 - (b) Trigger to signal interest in the topic, e.g. topicalizer and/or specific question
 - (c) Self-oriented comment to contribute own experience to topic

The following gives a short example of a typical self-presentational sequence and its three possible endings.

1. A: Where are you from?
2. B: I'm from down under but I am living now in Munich.
3. A:
 - a) I see.
 - b) Great, do you like it?
 - c) I am also living in Munich!

Ideally, the self presentation acts as a catalyst that generates topics both interlocutors can contribute to in the ongoing conversation.

3.2 Topic Discussion

Initiated by the self presentations, the interlocutors ideally find topics to discuss in their first conversation. Svennevig gives an account on the subject areas that are prevalent in first encounters.

- other-oriented (47%): Topics that refer to the interlocutor and elicit personal information. Other-oriented topics are often initiated by a self-presentational question, which is met by an elaborate answer (see example above).

- self-oriented (27%): With self-oriented topics, the speaker introduces personal information about himself.
- both-oriented (2%): Rarely, topics are found that refer to personal information of both interlocutors at the same time.
- encyclopedic (14%): Topics that belong to a broader socio-cultural context (politics, literature, music). Such topics count as neutral but are often related to personal experience because the speaker has a personal interest in the topic otherwise he would not choose to talk about it.
- setting-oriented (10%): Neutral topic that refers to the immediate situation and surroundings, for instance, discussion about the location of the conference. Although setting talk comprises only 10% of overall topics in first encounters, around 80% of such encounters start with setting talk.

Svennevig's analysis is based on observations in face to face encounters. It remains to be shown, if the regularities he observed also take place in a simulated face to face situation like Second Life.

4. GETTING ACQUAINTED IN SECOND LIFE

In the last section, we explained the structure of first meetings following the analysis by Svennevig. We could base the modeling of our agents on this analysis as has been done before (e.g. [2]). On the other hand, Svennevig's analysis focused on real life, face to face encounters. Our agents are going to interact with users in the virtual world of Second Life that realizes some kind of face to face encounter but does not compare to a real encounter. Thus, the question arises, if the structure of the real life conversations is also visible in Second Life encounters. To answer this question, we sent our agent into Second Life for a day and let it record the conversations taking place in the starting region Ahern of Second Life (see Figure 1). This region was chosen because most users in this area are keen to get acquainted with others. The agent did not take part in any interactions and did not react if it was addressed directly. We collected 10 conversations that were analyzed following the suggestions by Svennevig. The following dialogue serves as an example to highlight some of the differences between the real life conversations and the Second Life conversations.¹

```
14:13:34-Kurotaw Sands: Hi kushana... whatsup?
14:13:42-Kushana Alcott: hi kurotaw
14:13:54-Kurotaw Sands: You a regular?
14:14:05-Kushana Alcott: in sl?
14:14:08-Kushana Alcott: yes
14:14:11-Kurotaw Sands: Yeah...
14:14:16-Kurotaw Sands: I'm new here...
14:14:18-Kushana Alcott: yes
14:14:21-Kushana Alcott: almost 2 years
14:14:46-Kurotaw Sands: Wow... a veteran.
14:14:50-Kurotaw Sands: Where are you from?
```

¹ Avatar names of users have been anonymized.

```
14:15:06-Kushana Alcott: lol
14:15:10-Kushana Alcott: oklahoma
14:15:27-Kurotaw Sands: Nice. I'm from down under...
14:15:36-Kushana Alcott: ooo an uazzie
14:15:47-Kushana Alcott: auzzie
14:15:49-Kushana Alcott: lol
...
14:19:12-Kurotaw Sands: I hope the credi crunch
                        hasn't affected you too
                        badly..
14:19:30-Kushana Alcott: nah my health has
14:19:31-Kushana Alcott: lol
14:19:52-Kurotaw Sands: You keeping fit and all?
14:20:22-Kushana Alcott: all the partying in my
                        younger days caught up
14:20:46-Kushana Alcott: lol
14:21:05-Kurotaw Sands: I can fly?
14:21:08-Kushana Alcott: yes
14:21:09-Kurotaw Sands: woohoo...
14:21:12-Kushana Alcott: lol
14:22:04-Kushana Alcott: do u like blue's music
14:22:30-Kurotaw Sands: Yeah, it's not bad.
14:22:49-Kurotaw Sands: Is it me, or are there
                        people talking in the
                        background?
14:23:05-Kushana Alcott: they r using there mics
14:23:12-Kushana Alcott: voice
14:23:26-Kurotaw Sands: Uh huh...
14:23:41-Kurotaw Sands: Kinda annoying.
14:23:43-Kushana Alcott: see at the bottom right
                        of yur window
14:24:00-Kushana Alcott: u can turn them down
14:24:09-Kurotaw Sands: Yeah, thanks for that.
... (continues for 12 minutes)
```

Directly at the beginning of this conversation we can see a difference to real life encounters. In Second Life, the nickname of each user is visible for everybody. Thus, the typical starting question for the other's name is redundant in this setting resulting in the first turn by Kurotaw, where he uses the other's name in his greeting (**Hi kushana... whatsup?**). With his next turn, Kurotaw initiates a self-presentational sequence by asking Kushana of her experience with Second Life (**You a regular?**). Another difference to the real life setting is visible in the next few turns, where the answer of Kushana and the self presentations of Kurotaw (**I'm new here...**) overlap, which is a standard problem/feature of text-based chat systems. This sequence ends with Kurotaw's introduction of a new topic (**Where are you from?**). Overall, this introductory sequence follows Svennevig's analysis in general but exhibits also some differences that are due to the technical conditions of the communication medium. The second sequence presented above exemplifies another difference to real life settings. Although Kurotaw and Kushana find topics to discuss, their discussions are characterized by frequent topic shifts. In the six dialogue turns from 14:19:12 to 14:22:30, four topics are introduced and dropped again (credit crunch, health, flying, music). The last part of this conversation gives an example of how Second Life itself (i.e. the setting) becomes a topic worth of discussion which is a frequently observed phenomenon in the recorded conversations.



Figure 1: Snapshot from Second Life region Ahern.

The analysis revealed some similarities but also differences between the two settings. In real life as well as in Second Life, talk about the setting itself dominates the beginning of the conversation. The self presentation sequences are concentrating on the social affiliation and on biographical information. In most cases, a benevolent atmosphere prevails. But the Second Life chats also show some important differences. Topics are chosen predominantly from the area of Second Life itself. Moreover, topics are not discussed coherently but the conversations are characterized by frequent topic shifts. Most conversations are characterized by a thoughtless choice of words resulting in outwardly very informal conversations. Additionally, the conversations incorporate a number of standard chat slang as well as Second Life specific slang. Thus, users are frequently referring to abbreviations like lol (laughing out loud), ty (thank you) or yvw (you are very welcome). Specific to the Second Life setting are notions like residents (the users) or avi (avatar). Consequently, our agent has to be acquainted with these abbreviations and should use them itself.

5. GETTING ACQUAINTED WITH VIRTUAL AGENTS

In the previous sections, we have shown how humans get acquainted in real and in Second Life. This comparison revealed similarities and differences in the communications. Now the question arises if it suffices if an agent follows the general rules suggested by Svennevig or if it is necessary to integrate the differences for the Second Life encounters. To evaluate the different approaches and their usefulness in Second Life, we modeled two types of agents, the first one adhering to principles extracted from real life communications, the second one to those extracted from the communication in Second Life.

```
(R1) what can or(i,you) do in or(sl,[second life])
    -> answer(value:'what do you mean? im new and i
        have no clue of this all.')
(R2) i or(need,want) %to change my or(appearance,cloths,
        hair,look,outfit,
        style) %now
    -> answer(value:'i dont know how to do that, but
        you already look nice.')
(R3) rofl -> answer(value:'very funny.')
(R4) or(thanks,thx,ty) -> answer(value:'no problem.')
(R5) what %are you planning for the %rest %of %the day
    -> answer(value:'not much. and you?')
(R6) %are you or(divorced,married,single,solo) %at %the
    %moment
    -> answer(value:'i am single at the moment. do you
        have someone?')
```

Figure 2: Section of rule set following Svennevig's analysis.

The conversational behavior of the agent has been realized with SPIN, a rule-based language generation system [6]. To this end, production rules for the two versions had to be implemented (see Figures 2 and 3). Additionally, a general rule base has been compiled out of standard AIML pattern data bases in order to allow the agent a more general coverage of topics.

The following conversation is an example of a user-agent interaction following the first rule set (Figure 2):

```

(R1) what can or(i,you) do in or(sl,[second life])
    -> answer(value:''you really can do a lot. what do
        you want to know?')
(R2) i or(need,want) %to change my or(appearance,cloths,
        hair,look,outfit,
        style) %now
    -> answer(value:''you need to open appearance mode.
        right-click your avatar.'')
(R3) rofl -> answer(value:''LOL!'') random pickup line
(R4) or(thanks,thx,ty) -> answer(value:''np.'')
(R5) what %are you planning for the %rest %of %the day
    -> answer(value:''not much.'')
        answer(value:''and btw:'') random pickup line
(R6) %are you or(divorced,married,single,solo) %at %the
    %moment
    -> answer(value:''i am single at the moment. do you
        have someone?')
        answer(value:''and btw:'') random pickup line

```

Figure 3: Section of rule set following the analysis of Second Life conversations.

```

14:06:57-Shiva Scarmon: hi there Gikkuri Wollongong
14:07:13-Gikkuri Wollongong: hi shiva
14:07:13-Shiva Scarmon: hello there.
14:07:25-Gikkuri Wollongong: how r ya
14:07:25-Shiva Scarmon: quite good. how about you?
14:07:33-Gikkuri Wollongong: im fine
14:07:33-Shiva Scarmon: good to hear that.
14:08:05-Gikkuri Wollongong: im totally new here.
        what is good to do here
14:08:05-Shiva Scarmon: me too. good to hear that.
14:08:21-Gikkuri Wollongong: aha
14:08:33-Gikkuri Wollongong: so, where r ya from
14:08:33-Shiva Scarmon: i am from london in england.
        and you?
14:09:06-Gikkuri Wollongong: im from austria
14:11:14-Gikkuri Wollongong: do you know austria
14:11:14-Shiva Scarmon: im sorry, i have no clue.
14:11:25-Gikkuri Wollongong: its near germany
14:11:40-Gikkuri Wollongong: do you like london
14:11:40-Shiva Scarmon: not really. and you?
14:11:59-Gikkuri Wollongong: why? i thought its an
        amazing town
14:12:25-Gikkuri Wollongong: shiva i have to leave,
        sorry
14:12:25-Shiva Scarmon: adios.

```

To give an impression of the differences of the two rule sets, compare the above example with a conversation following the second rule set (Figure 3), which is based on the analysis of the Second Life conversations:

```

10:06:34-Shiva Scarmon: hi there Lastelle Oddofen
10:06:49-Lastelle Oddofen: Hello
10:06:49-Shiva Scarmon: hi there!
10:06:55-Lastelle Oddofen: how are you
10:06:55-Shiva Scarmon: pretty okay. how about you?
10:07:29-Lastelle Oddofen: I am good.
10:07:29-Shiva Scarmon: good to hear that.

```

```

10:08:19-Lastelle Oddofen: I am still trying to find
        you.
10:09:20-Lastelle Oddofen: Ahh you look like a cloud
        to me.
10:09:20-Shiva Scarmon: i know, it is lag. never
        mind. what is your real
        name?
10:09:47-Lastelle Oddofen: I don't want to say. No
        offence
10:09:47-Shiva Scarmon: pardon me?
10:10:28-Lastelle Oddofen: Don't worry
10:11:38-Lastelle Oddofen: So where are you from? I
        live in New Zealand.
10:11:38-Shiva Scarmon: interesting. how do you like
        it there?
10:12:03-Lastelle Oddofen: I love it.
10:12:35-Lastelle Oddofen: I live in the country
        side.
10:12:35-Shiva Scarmon: interesting. how do you
        like it there?
10:12:50-Lastelle Oddofen: What country are you
        from?
10:12:50-Shiva Scarmon: i am from london in
        england. and you?
10:13:31-Lastelle Oddofen: New Zealand but as my
        parents are English I
        count myself as part
        British.
10:15:09-Lastelle Oddofen: So do you like it in
        London?
10:15:09-Shiva Scarmon: no. i dont really like
        London. do you know how
        i can buy a house in SL?
10:15:17-Lastelle Oddofen: I have been there once.
10:15:55-Lastelle Oddofen: I am sorry I don't.
10:15:55-Shiva Scarmon: no worries.
10:16:31-Lastelle Oddofen: I think there is a
        freebie house on the
        NCI freebie boards.
10:16:31-Shiva Scarmon: yes, sure. please.
10:16:56-Lastelle Oddofen: I dont know where you
        would put it or buy
        land.
10:17:31-Lastelle Oddofen: I have not done any of
        that yet
10:17:31-Shiva Scarmon: that's cool.
10:17:55-Lastelle Oddofen: Would you like to join
        NCI and see it the house
        is still there
10:17:55-Shiva Scarmon: sure. do you prefer books
        or tv?
10:18:13-Lastelle Oddofen: depends on my mood
10:19:17-Lastelle Oddofen: To join find the little
        penguin and click on it.

```

In this case, the agent has specific information about the Second Life setting allowing the agent to react to technical issues (i know, it is lag) or to introduce topics relating to the setting (do you know how i can buy a house in SL?). Additionally, the agent has the ability to change topics rapidly during a conversation (sure. do you prefer books or tv?) even when this interrupts the flow of the conversation. In the example above, this typical Second

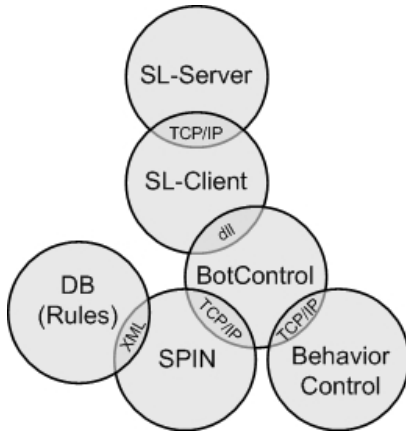


Figure 4: Architecture for controlling agents in Second Life. For the current study, the Behavior Control component has been disabled.

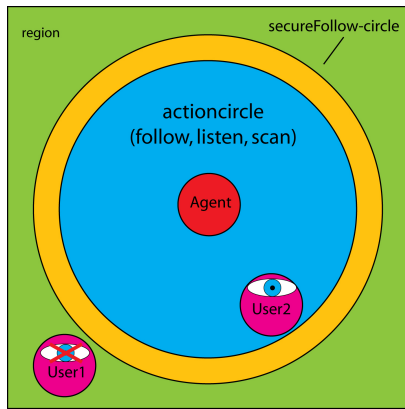


Figure 5: Realizing proxemics behavior of the agent by defining an interaction area encompassing Hall's [7] social distance.

Life behavior does not lead to confusion on the side of the user but she accepts this deviation (**depends on my mood**) and then takes up the previous topic (**To join find the little penguin and click on it.**).

The SPIN language generation has been integrated into the Second Life control architecture [14] (see Figure 4). The control architecture combines the low-level behavior control for animating an agent, sending and receiving speech events, and for navigating through the environment with a high-level behavior control, which abstracts from the tedious work of controlling every parameter for the agent in Second Life. Whereas the original version incorporated an agent behavior component [12], which simulates social group behaviors, this was not necessary for the current experiment. The agent's behavior was confined to chat interactions. As has been pointed out in [11], a drawback of the Second Life chat system is complete awareness of the whole chat that is going on between all of the agents. As we aim at modeling realistic agent behaviors, the perceptions of our Second Life agents are restricted following suggestions of Hall [7] on spatial behavior in communications. Thus, our agent only

reacts to avatars that are in a social distance of maximal 3.6 meters. This behavior is depicted in Figure 5. User 1 is not in range and is thus disregarded by the agent, user 2 has entered the agent's space in a social distance and thus attracts the agent's attention. If an agent has already entered the interaction area and then attempts to leave in an ongoing communication, the agent will follow the user as long as he is not stepping out of the "secureFollow" circle. This has been shown to be necessary when the user is situated at the far end of the action circle during the communication because he might accidentally step out of the action circle rendering the communication to come to an abrupt end.

6. EVALUATION

Our ultimate goal is to establish trust between the user and the agent in order to allow for more complex interactions. As we pointed out in the beginning, getting acquainted is important in initially building up trust. To evaluate how well an agent performed depending on the rule sets that were applied, we defined the success of such a first meeting along the dimension of engagement following suggestions by Iacobelli and Cassell [8]. In their approach, the length of a conversation is taken as an indicator that the conversation was not boring enough to dismiss it. Length is measured in terms of number of dialogue turns and number of words from the user. Longer turns from the user, measured by the number of words per turn, indicate a higher linguistic complexity in the whole conversation, which in turn is taken as another indicator for an engaging interaction. Thus, we have two predictors for measuring engagement, number of turns and number of words per turn. By measuring the length of a conversation and its complexity, we can analyze, which of the rule sets are successful in drawing the user into this conversation and keep him interested. Otherwise, the user could just leave the conversation.

Both rule sets have been modeled based on the analysis of human dialogues, either in the real life or in Second Life. It can be expected that both rule sets will – at least partly – work successfully. Thus, we created a benchmark to test the rule sets against by sending a bot into Second Life that is based on the standard AIML rule set, which aims at implementing a general chatterbot. As a result, the evaluation is based on three hypotheses:

- H1 Conversations with an agent that follows real life patterns of first meetings are more engaging than conversations with an agent that uses only standard patterns.
- H2 Conversations with an agent that follows Second Life patterns of first meetings are more engaging than conversations with an agent that uses only standard patterns.
- H3 Conversations with an agent that follows Second Life patterns of first meetings are more engaging than conversations with an agent that follows real life patterns of first meetings.

If hypothesis three is valid, we expect a smaller effect compared to hypotheses one and two because although an agent

	Real Life Pattern	Second Life Pattern	Standard Pattern
# turns	6.89	7.5	4
# words	44.44	49.58	14.33
# words/turns	6.45	6.61	3.54

Table 1: Results for engagement predictors in the three conditions.

with the Second Life patterns for first meetings is better adapted to the context in which the conversation takes place, the real life patterns might nevertheless be applicable especially with new users.

In each of the three trials (real life, Second Life, standard), the agent was positioned in the central starting area of Second Life (Ahera). The agent was proactive and addressed users that came into the social distance. Conversations were logged for the analysis. No other information was recorded. Thus, anonymity of users continued to remain untouched by the experiment. For each condition, 12 conversations have been recorded. A minimal length of turns was defined for including the conversation into the analysis. This was necessary because the interactions in Second Life are sometimes quite erratic, turns are started and then the interlocutor decides otherwise and moves or teleports away. Thus, only interactions that lasted for at least three turns were counted as conversations.

6.1 Results

Table 1 gives the results of the experiment. A pair-wise t-test revealed no significant differences between the real life and the Second Life condition for all three predictors. The comparison of real life and standard condition yielded significant differences for all predictors (words: $t = 2.376$, $p < 0.05$; turns: $t = 2.788$, $p < 0.05$; w/t: $t = 2.198$, $p < 0.05$). The results for the comparison of the Second Life and standard condition are highly significant for all predictors (words: $t = 3.879$, $p < 0.01$; turns: $t = 3.514$, $p < 0.01$; w/t: $t = 4.079$, $p < 0.01$).

6.2 Discussion

The results back up our first two hypotheses. Modeling behavior that is found either in real life or in Second Life for first meeting encounters proves to be successful in terms of engagement compared to a standard chatterbot program. Thus, by integrating findings about human communication, the interaction with an agent in a virtual world like Second Life can be rendered more engaging and successful. Our third hypothesis, that by taking the specifics of Second Life into account for modeling the agent’s interaction behavior did not prove to be more successful than relying on behavior found in real life when both conditions are directly compared. The results for the comparison of either rule set with the standard chatterbot indicate that the Second Life rule set is a little more successful as the results are on a higher level of significance. That both rule sets are successful in the first meeting encounters is not too surprising as the real life patterns are presumably well known by the users who can relate to this kind of behavior also in the virtual environment.

The statistical data for hypotheses one and two are unambiguous. Thus, the standard AIML patterns do not provide the agent with the relevant knowledge for first meeting encounters in this context as is exemplified by the following dialogue which is one of the longer interchanges between a user and the standard agent.

```

16:58:48-Yuuko Charron: pleased to meet ... you
16:58:48-Shiva Scarmon: Tell me more about you,
                        Yuuko Charron.
16:59:20-Yuuko Charron: You are very strange
16:59:20-Shiva Scarmon: I like the way you talk.
16:59:33-Yuuko Charron: Oh
16:59:33-Shiva Scarmon: Hey. Would it matter to you
                        if I am?
17:00:23-Yuuko Charron: No
17:00:23-Shiva Scarmon: It's all good.
17:03:32-Yuuko Charron: I know
17:03:32-Shiva Scarmon: How, specifically, do you
                        know?
17:03:45-Yuuko Charron: Completely
17:03:45-Shiva Scarmon: Oh.

```

What is apparent in this example is that by disregarding the norms that have been shown above to exist in real life and in Second Life first meeting encounters renders the dialogue meaningless due to the purely reactive nature of the agent that has no knowledge about self presentation sequences or topic selection. Thus, most of the dialogues following the standard repertoire ended soon after some catchy greeting phrases.

Second Life in principle allows communication across national and/or cultural boundaries. The cultural background of a given avatar cannot be guessed by the avatar look and, if the user behind it communicates in English, not necessarily by the language of the communication. Thus, an interesting question is if and how culture does matter in Second Life interactions. It has been shown that cultural differences exist in first meeting encounters [13]. Actually, the patterns found in our analysis of Second Life first meeting encounters are comparable to Japanese patterns of getting acquainted [5]. It would be interesting to examine if there are cultural differences in engagement in SecondLife. For this endeavour it would be necessary to know the cultural backgrounds of the users which in the current setting can only be inferred from the conversation itself.

7. CONCLUSION

Collaborative virtual worlds offer rich playgrounds for human agent interactions. Both human and agent have the same appearance and the same communication channels at their disposal allowing for symmetric input and output on both sides. Thus, agents blend into a community without being outwardly identifiable. This offers the chance for employing agents in numerous in-world application domains like intelligent tutoring, persuasion or games. To succeed, the agent has to convince the user that it is trustworthy. In this paper we have examined one of the major interaction rituals for building trust, getting acquainted for the first time. We have shown that different rituals can be observed

in real life and Second Life and that – as the evaluation showed – both allow the agent to get in touch with the user. On the other hand, when the agent followed rules that were not observed in the getting acquainted ritual either in real life or in Second Life, the interaction was in most cases not convincing for the user.

Currently, we have measured trust by examining how engaged the user is in the interaction which was sufficient as a first step but does not result in very detailed information on how the user experiences the interaction with the agent. To this end, we plan to integrate a previously developed component for social group dynamics [12] that allows predicting relational parameters of the user towards the agent on the basis of socio-psychological theories. With this information at hand, more fine grained analyses of the user's relation towards the agent and the development of this relation become possible allowing for dynamically adapting the agent's interaction protocol to the predicted outcome.

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